FPL Energy
Seabrook Station

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May 30, 2006

Docket No. 50-443

SBK-L-06119

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Seabrook Station

Relaxation Request from the First Revised NRC Order EA-03-009 Regarding Requirements for Nondestructive Examination of Nozzles Below the J-Groove

Reference: Florida Power and Light letter L-2004-054, Answer to Revised Order EA-003-009, March 10, 2004.

On February 11, 2003, the NRC issued Order EA-03-009 for interim inspection requirements for reactor pressure vessel (RPV) heads at pressurized water reactor (PWR) facilities. On February 20, 2004, the NRC issued the First Revised Order EA-03-009, which superseded Order EA-03-009. FPL Energy Seabrook, LLC (FPL Energy Seabrook) agreed to comply with the revised order in letter L-2004-054.

This letter requests relaxation from the requirements for nondestructive examination of five penetration nozzles for which FPL Energy Seabrook cannot obtain coverage as specified in the Order. In accordance with section IV, paragraph F of the Order, FPL Energy Seabrook requests relaxation from the requirements specified in section IV, paragraph C.(5)(b)(i) and C.(5)(b)(ii) for the five RPV head penetrations for which nondestructive testing cannot be performed as required. The requested relaxation meets criterion IV.F.(2) of the revised Order because compliance with the revised Order for the penetrations described in this request would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Attachment 1 to this letter contains the relaxation request. Attachment 2, WCAP-16550-P, Revision 0, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: Seabrook Station," April 2006 (Proprietary), provides the engineering justification for this request. A non-proprietary version of WCAP-16550-P is included in Attachment 4. Attachment 2 contains information proprietary to Westinghouse Electric Company LLC, and is supported by an affidavit (Attachment 3) signed by Westinghouse, the owner of the information. The

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affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b) (4) of Section 2.390 of the Commission's regulations. Accordingly, it is respectfully requested that the information that is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations. Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-06-2134 and should be addressed to B. F. Maurer, Acting Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

FPL Energy Seabrook requests NRC approval of this relaxation request by October 1, 2006, to support the refueling outage scheduled to begin on that date.

Should you require further information regarding this matter, please contact Mr. James M. Peschel, Regulatory Programs Manager (603) 773-7194.

Very truly yours,

FPL Energy Seabrook, LLC

Gene St. Pierre
Site Vice President

cc: S. J. Collins, NRC Region I Administrator
G. E. Miller, NRC Project Manager
G. T. Dentel, NRC Resident Inspector

Attachment 1 to SBK-L-06119

Attachment 1

FPL ENERGY SEABROOK RELAXATION REQUEST
FROM THE FIRST REVISED NRC ORDER EA-03-009 REGARDING
REQUIREMENTS FOR NONDESTRUCTIVE EXAMINATION OF NOZZLES
BELOW THE J-GROOVE WELD

Submitted in accordance with Revised NRC Order EA-03-009, Section IV.F, Criterion (2): Compliance with the Order for Specific Nozzles Would Result in Hardship or Unusual Difficulty without a Compensating Increase in the Level of Quality and Safety.

1. ASME Component Affected

FPL Energy, Seabrook LLC (FPL Energy Seabrook) Unit 1 reactor pressure vessel (RPV) head control rod drive mechanism (CRDM) penetrations 74, 75, 76, 77, and 78.

2. Applicable Examination Requirements

The FPL Energy Seabrook Unit 1 RPV head is in the low susceptibility category as defined in Sections IV. A and IV.B of Revised NRC Order, EA-03-009[1]. The calculated Effective Degradation Years (EDY) for Seabrook was 2.08 at the end of Cycle 9. Plants with an EDY of less than 8 and no previous inspection findings are placed in the low susceptibility category. Pursuant to Section IV.C (3) of the revised order, the RPV head penetration nozzles must undergo nondestructive examination in accordance with Section IV.C (5)(b) of the revised order during the Fall 2006, Cycle 11 refueling outage. In accordance with Section IV.C (5)(b) of the revised order, the nondestructive examination consists of ultrasonic testing, eddy current testing, or dye penetrant testing of RPV head penetration nozzle base material and J-groove weld that attaches the nozzle base material to the underside of the head.

The required extent of the ultrasonic testing is stated in Section IV.C (5)(b)(i) of the revised order, which provides the following two options:

> Ultrasonic testing of the RPV head penetration nozzle volume (i.e. nozzle base material) from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a

[1] Revised NRC Order EA-03-009, "Issuance of First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated February 20, 2004.

horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches [see Figure IV-1] [of the revised order]);

OR

From 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0 inches below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-2 of the revised order).

The required extent of the eddy current and dye penetrant testing is stated in Section IV. C (5)(b)(ii) of the revised order, which provides the following two options:

Eddy current testing or dye penetrant testing of the entire wetted surface of the J-Groove weld and the wetted surface of the RPV head penetration nozzle base material from at least 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches (see Figure IV-3 of the revised order);

OR

From 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0 inch below the lowest point at the toe of the J-Groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-4 of the revised order).

3. Reason for Request

FPL Energy, Seabrook is proposing an alternative to the above requirements for the inspections at the end of cycle 11 and all future CRDM nozzle inspections, because for certain CRDM nozzles, compliance with the revised order would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The Reactor Vessel Head CRDM Penetrations at Seabrook have two styles of ends, referred to as Type "X" and Type "Y" (Figure 2). Penetrations 1

through 73 are Type "Y" that are essentially a smooth wall cylinder with a 0.203 radius at the outer diameter and inner diameter. Penetrations 74 through 78 have a threaded outside diameter and an internal taper.

The design of RPV head penetration nozzles 74 through 78, referred to as Type "X", (Figure 1 and Figure 2) includes a threaded section, approximately 1.19 inch in length at the bottom of the nozzles. These penetrations are located at the 48.7 degree location. The dimensional configuration at this location is such that the distance from the lowest point at the toe of the J-groove weld to the top of the threaded region is less than the 1-inch lower boundary limit specified in IV.C.5 (b)(i) and IV.C.5 (b)(ii) of the First Revised Order.

The Open Housing Probe will be used on the threaded penetrations to detect circumferential flaws and axial flaws. This probe has separate transducers arranged vertically and horizontally for sending and receiving the ultrasonic signal. Both transducer configurations are qualified to detect both axial and circumferential flaws.

With the vertical configuration, the lower transducer will not contact the inside wall of the nozzle unless the upper transducer has been inserted greater than approximately 1.0 inches into the nozzle above where the taper ends. The horizontal transducer configuration has to be inserted above the end of the internal taper for the transducers to make contact with the surface of the CRDM nozzle.

FPL Energy Seabrook anticipates not being able to completely comply with the requirements for UT inspection of penetration nozzles 74 through 78 below the J-groove weld, due to the physical configuration of the nozzles and the limitations of the test equipment. The bottom ends of these nozzles are externally threaded and internally tapered. Loss of UT probe coupling due to the internal taper and or disruption of the UT signal due to the external thread will prevent UT data acquisition.

4. Proposed Alternative and Basis For Use

FPL Energy Seabrook proposes to define the lower boundary of the inspection volume for the five affected RPV head penetration nozzles as:

> *From 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to the maximum extent practical but not less than 0.30 inches below the lowest point at the toe of the J-Groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-*

groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater for Penetrations 74, 75, 76, 77, and 78.

For Penetrations 1-73, the inspection will be performed from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to the maximum extent practical but not less than 1.0 inches below the lowest point at the toe of the J-Groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operating stresses) of 20 ksi tension and greater.

It is FPL Energy Seabrook's intent to perform the examination to the maximum extent possible for all penetrations. FPL Energy Seabrook will achieve examination coverage from two inches above the J-Groove weld down to the lowest elevation that can be practically examined with the Open Housing Probe, as shown in Figure 5, but not less than 0.30 inches below the toe of the weld on the downhill side for penetrations 74 through 78. If examination coverage can not be achieved for Penetrations 1 through 73, FPL Energy Seabrook will submit a relaxation request for those penetrations.

Testing of portions of the nozzle significantly below the J-Groove weld is not significant to the phenomena of concern. The phenomena that are of concern are leakage through the pressure boundary and circumferential cracking in the nozzle above the J-groove weld. The nozzle is essentially an open-ended tube, and the nozzle wall below the J-groove weld is not part of the reactor coolant (RCS) pressure boundary.

In the event that a circumferential crack existed in the region that could not be inspected by the Open Housing Probe, it would not be safety significant.

FPL Energy Seabrook anticipates fully complying with the requirements for UT inspection in penetrations 1 through 73. These penetrations are a smooth cylinder in shape and pose no known impediments for compliance with the Order.

The design of RPV head penetration nozzles 74 through 78 (Figures 1 and 2) includes a threaded section, approximately 1.19-inch length at the bottom of the nozzles. These penetrations are located at the 48.7 degree location. The dimensional configuration at this location is such that the distance from the lowest point at the toe of the J-groove weld to the top of the threaded region is potentially less than the 1-inch lower boundary limit specified in IV.C.5 (b)(i) and IV.C.5 (b)(ii) of the First Revised Order. Therefore, FPL Energy Seabrook anticipates not being able to completely comply with the requirements for UT inspection below the J-groove weld, due to the physical

configuration of the nozzles. Loss of UT probe coupling due to the internal taper and/or the disruption of the UT signal due to the external thread will prevent UT data acquisition from the ID and the threads on the OD. FPL Energy Seabrook proposes that the lower boundary of the Ultrasonic inspection extend to the maximum extent possible but not less than 0.30 inches from the toe of the J-groove weld on the downhill side (figure 5). The actual distance between the toe of the weld on the downhill side and the thread relief is not known for Unit 1. However, measurements made on the Unit 2 head shows that the dimension varies between 0.25 inches and 0.75 inches.

The NRC has identified 20 ksi operating stress level as a threshold necessary to initiate Primary Water Stress Corrosion Cracking (PWSCC). The threshold stress is incorporated into the First Revised Order by reducing the inspection area below the J-Groove weld from 2 inches to 1 inch if the operating stresses are below 20 ksi. The assumption of any PWSCC crack initiation in the region of the penetration nozzle with a stress level of 20 ksi or less is very conservative.

To support the submittal of the relaxation request, in the event that the required 1 inch inspection coverage below the weld cannot be achieved, a series of operational stress plots and axial through-wall crack growth charts for below the weld on the downhill side were prepared using a flaw tolerance approach [2]. The plots for the 48.7 degree penetrations applicable to this relaxation request are shown in Figures 3 and 4. Figure 4 shows the distance below the weld on the downhill side at which the stresses drop below 20 ksi. The distance on the ID surface is at the weld toe and the distance on the OD surface is at 0.30 inches. Therefore, examination to a minimum of 0.30 inches below the weld for these penetrations would satisfy the 20 ksi stress criteria of the Order, thereby minimizing the potential for cracking to exist in the un-inspected areas of the nozzle.

The time duration required for the upper extremity of a postulated axial through-wall flaw to reach the bottom of the weld can be determined from Figure 3. For example, for CRDM nozzles 74 through 78, a axial through wall flaw that has its upper extremity located at 0.15 inches below the weld would take over 6 effective full power years to reach the weld. The results of the flaw propagation calculation indicate that, even if a through wall axial flaw were to occur in the region of the penetration nozzle not being inspected, there would be adequate opportunity for crack detection in the subsequent inspection, per the frequency stated in the Order, prior to reaching the RCS pressure boundary. If a circumferential flaw were to occur in the region of the nozzle that is not inspected, it is not a safety concern since it would not result in pressure boundary leakage.

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[2] WCAP-16550-P, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: Seabrook Station," Westinghouse Electric Co. LLC, Revision 0, April 2006.

To reduce personnel radiation exposure, the nozzles are typically inspected using remotely operated ultrasonic or eddy current equipment. Although dye penetrant testing of threaded surfaces is possible, it is not practical. The threaded OD makes a dye penetrant examination on the lower section of the penetration impractical because of excessive bleed out from the threads. In addition, the radiation levels under the reactor vessel head are estimated to be 7000 mR/hour to 9000 mR/hour at the bottom of the CRDM nozzles resulting in an exposure of approximately 1750 to 2250 mR per nozzle. Actual dose measurements taken under the Reactor Vessel Head in 1995 and 1997 are between 4000 mR and 7000 mR/hour depending on guide funnel location. Similar exposure of this magnitude has been documented in the Florida Power and Light submittal for St. Lucie Unit 2 with manual PT of 9 nozzles resulting in 2.45 man Rem exposure[3]. In addition, there is no readily available remotely deliverable NDE technology that can inspect the threaded region.

In conclusion, FPL Energy Seabrook believes the inspection coverage is adequate because the cited inspection limitation of the nozzles does not preclude full UT examination coverage of the portions of these nozzles that are of primary interest because:

- UT of the most highly stressed portion of the nozzle (the weld heat affected zone) is unaffected by this limitation.

- UT of the interference fit zone above the weld is unaffected by this limitation, and cracks initiating in the unexamined bottom portion (non pressure boundary) of the nozzle would be of minimal safety significance with respect to pressure boundary leakage or nozzle ejection, since this portion of the nozzle is below the pressure boundary and any cracks would have to grow through a significant examined portion to reach the pressure boundary

- UT of the area that could contain safety significant flaws will be fully inspected.

    - UT for axial and circumferential indications will be done to the maximum extent possible to the point of lift off at the start of the internal taper, which is below 0.30 inches.

Additional efforts to achieve the Order required examination area below the weld would result in a hardship due to unusual difficulty without a compensating increase in the level of quality and safety.

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[3] Letter from William Jefferson, FP&L to USNRC Document Control Desk, "Request for Additional Information Response, Relaxation Request No. 3", Dated November 3, 2004.

5. **Duration of Relaxation**

FPL Energy Seabrook requests relaxation of this requirement for end of cycle 11 refueling outage inspection and all future inspections where ultrasonic examination techniques are used to inspect the five affected RPV head penetration nozzles in response to the requirements of the First Revised NRC Order EA-03-009, or until inspection technology is developed to a state where the examination volume can be extended to full compliance with the Order, or information is received from the NRC regarding non-acceptance of the crack growth formula in MRP-55.

The crack-growth rate formula used in the structural integrity evaluation for FPL Energy Seabrook is the same as reported in industry report MRP-55. If the NRC staff finds that the crack-growth formula in industry report MRP-55 is unacceptable, FPL Energy Seabrook will revise its analysis that justifies relaxation of the Order within 30 days after NRC informs FPL Energy Seabrook of an NRC approved crack-growth rate formula. If FPL Energy Seabrook's revised analysis shows that the crack-growth acceptance criteria are exceeded prior to the end of the current operating cycle, this relaxation request will be rescinded and FPL Energy Seabrook will, within 72 hours, submit to the NRC written justification for continued operation. If the revised analysis shows that the crack-growth acceptance criteria are exceeded during the subsequent operating cycle, FPL Energy Seabrook will, within 30 days, submit the revised analysis for NRC review. If the revised analysis shows that the crack-growth acceptance criteria are not exceeded during either the current operating cycle or the subsequent operating cycle, FPL Energy Seabrook will, within 30 days, submit a letter to the NRC confirming that its analysis has been revised.

5. **Precedents**

1. Letter from Donna Jacobs, PGE to USNRC, Document Control Desk, "Supplement 2 to Relaxation Request for NRC Issuance of First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors" dated February 7, 2006.

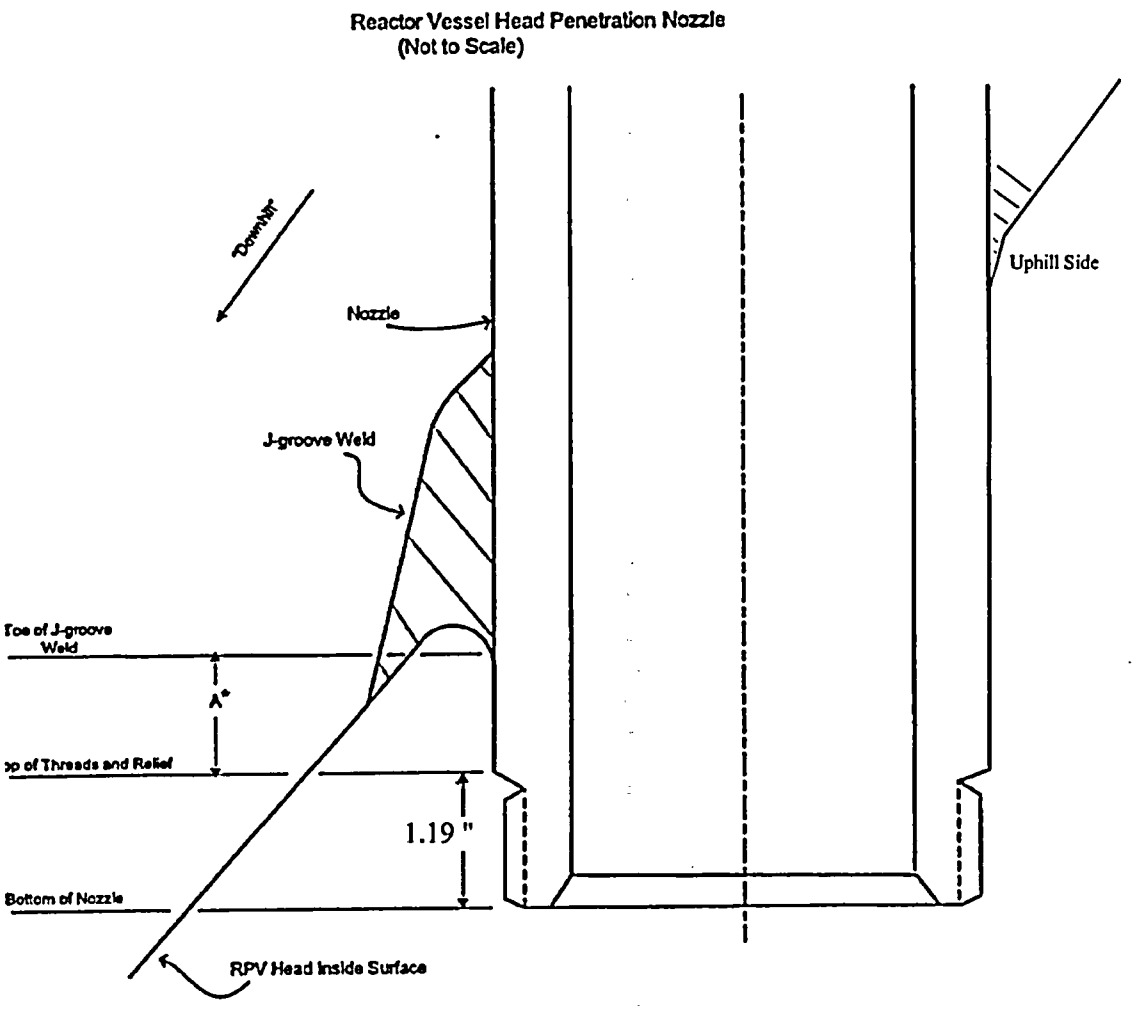
2. Letter from Daniel P Fadel, Indiana Michigan Power Company to USNRC, to Document Control Desk, "Request for Relaxation from Nuclear Regulatory Commission Revised Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors-Unit 1", dated January 20, 2005

3. Letter from Donna Jacobs, PGE to USNRC, Document Control Desk, "Relaxation Request for NRC Issuance of First Revised Order (EA-03-

009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors", dated May 27, 2005.

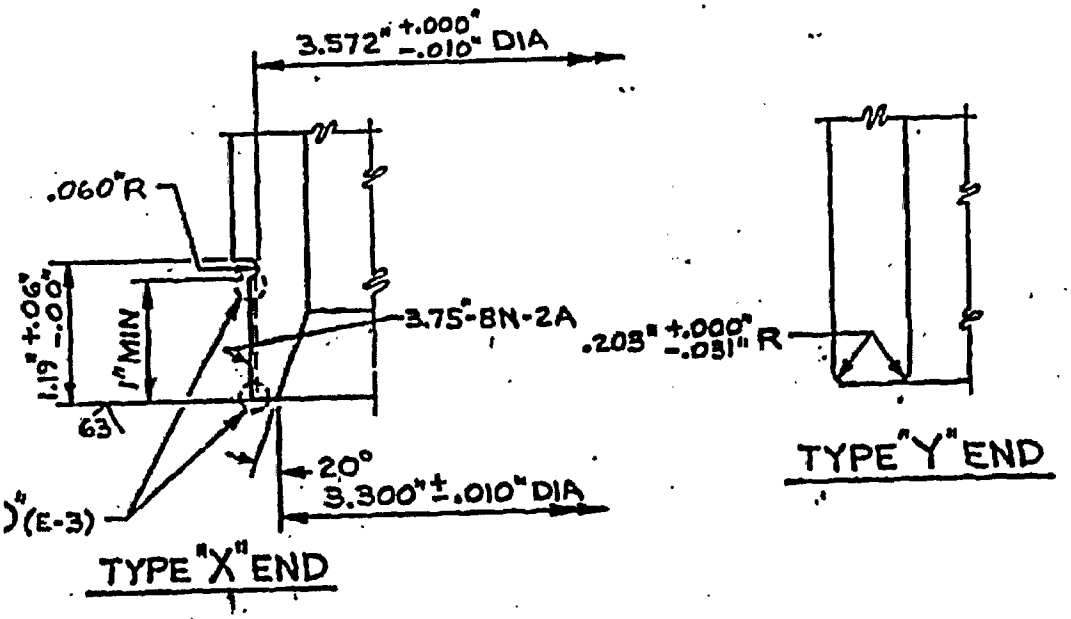
4. Letter from William Jefferson, FP&L to USNRC, Document Control Desk, "Request for Additional Information Response, Relaxation Request No. 3", dated November 3, 2004.

Figure 1



* The distance "A" on penetrations 74,75, 76, 77, and 78 may vary between 0.25" and 0.75 inches based on measurements taken in the Unit 2 RPV head. Actual measurements for Unit 1 have not been made.

Figure 2



Details of the threaded and tapered portion of Penetrations 74, 75, 76, 77, and 78 referred to as "Type X" and the end of Penetrations 1 through 73, referred to as "Type Y".

This Figure was taken from WCAP-16550-P, Revision 0

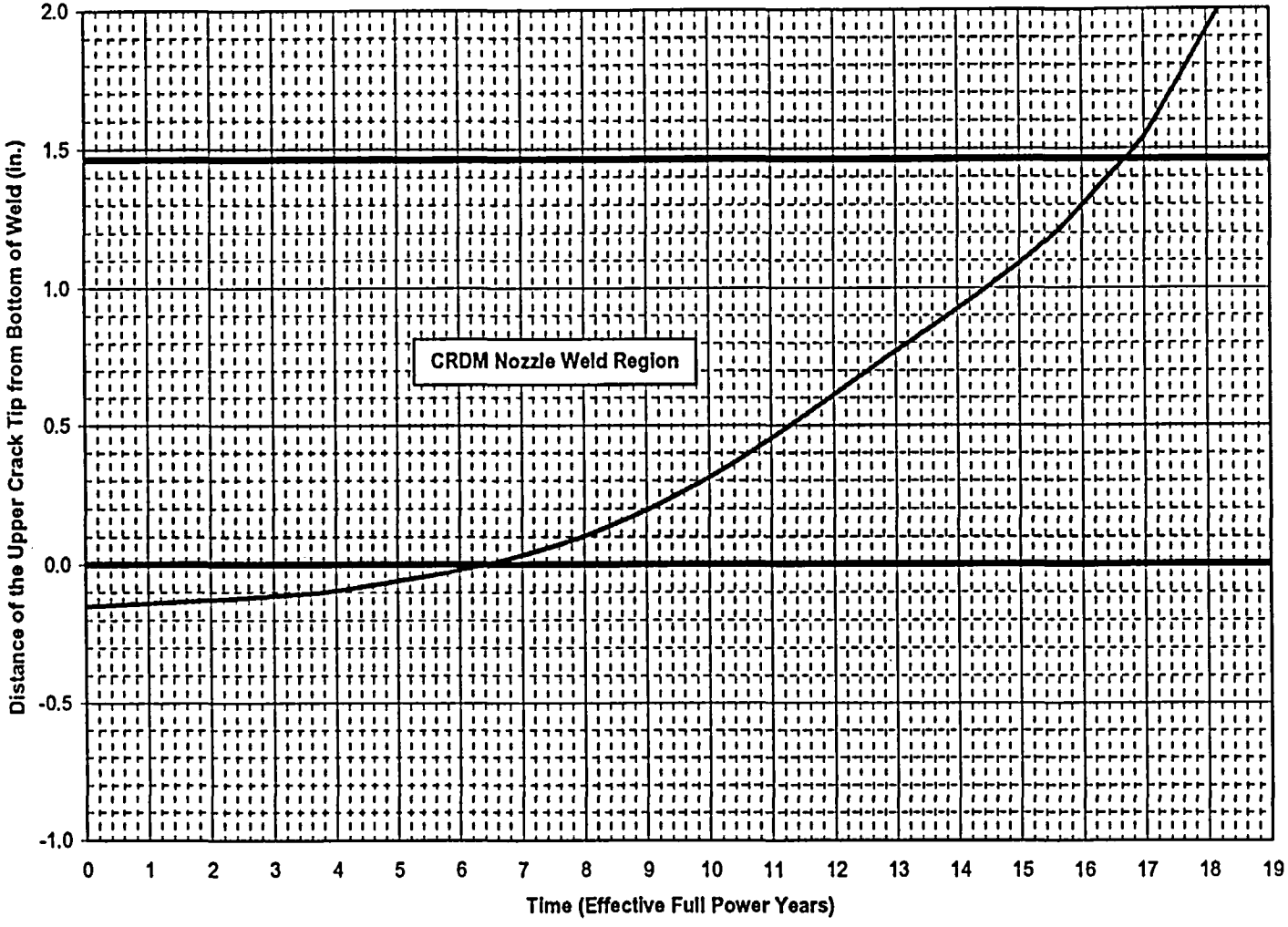
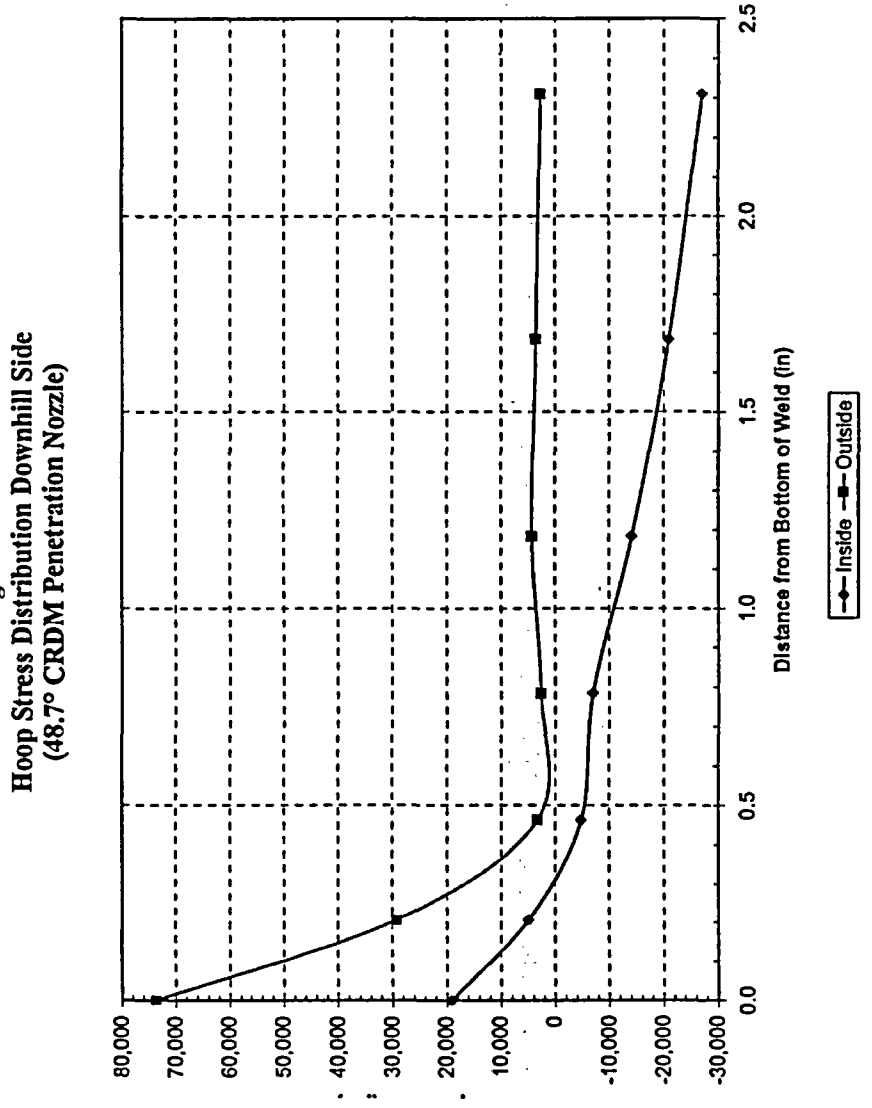


Figure 3

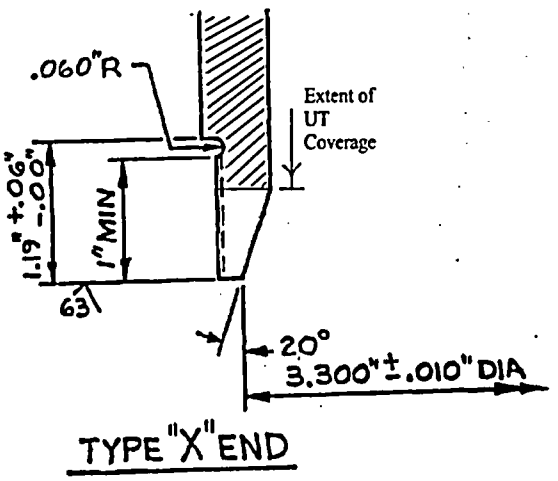
Figure 6-16 Through-Wall Longitudinal Flaws Located in the 48.7 Degrees CRDM Row of Penetrations, Downhill Side - Crack Growth Predictions for Seabrook

Figure 4



This Figure was taken from WCAP-16550-P, Revision 0

Figure 5



The shaded area shows the extent of the nozzle end that would be inspected for axial indications with the Open Housing Probe.